Each Acre to its Best Use . . .

A TOUR GUIDE of the SOIL CONSERVATION STATION

LACROSSE, WISCONSIN

Foreword

● This experimental farm is a service station for the farmers of this area. We welcome you to the Station and hope you will find helpful ideas to use in meeting your land use problems back home.

It was almost 100 years ago when the first portion of this farm was transferred from the government to a pioneer settler. The virgin land was then highly productive.

But after a half century of agricultural use the virgin fertility began to show signs of depletion. Crop yields were not as high as when the land was first opened up to the plow. Even the farms with much livestock, and hence generous supplies of barnyard manure, were unable to maintain their crop yields on the sloping fields. Small washes began to deepen and to form ugly gullies. To those who had discerning eyes, it became apparent that such fields were losing, not only their virgin fertility, but also large portions of the valuable topsoil itself.

In 1931 the University bought this farm, and invited the U. S. Department of Agriculture to cooperate in the planning and operation of the experiments which have had for their purpose the discovery of new and better ways of using the sloping land in this region for agriculture.

NOBLE CLARK
Associate Director
Wisconsin Agricultural
Experiment Station

Facts About the Station

THE Upper Mississippi Valley Soil Conservation Experiment Station is a farm of 160 acres three miles east of LaCrosse, Wisconsin. It is operated jointly by the University of Wisconsin and the United States Department of Agriculture.

Studies are being made to learn how to use this sloping soil most effectively, keep it productive, and prevent losses of valuable soil and water. The soil is a wind-deposited silt loam that is moderately permeable and well drained. The soil types under study are Fayette and Dubuque silt loams.

The Station has 50 acres of crop land, 35 acres of pasture, and 75 acres of woodland. As you will see, most of the land is under runoff measurement. There are 82 plots and watersheds including crop, pasture, and woodland. After each rain, each collecting tank is measured and sampled to find out exactly how much soil and water were lost. Conservation methods are being developed and tested here on the basis of results.

This farm was selected as being typical of dairy farms in the upper Mississippi valley. The fields on this farm were badly eroded and unproductive. The hay crop was mostly quack grass. Several of the fields were badly gullied. Much of the once fertile topsoil was gone.

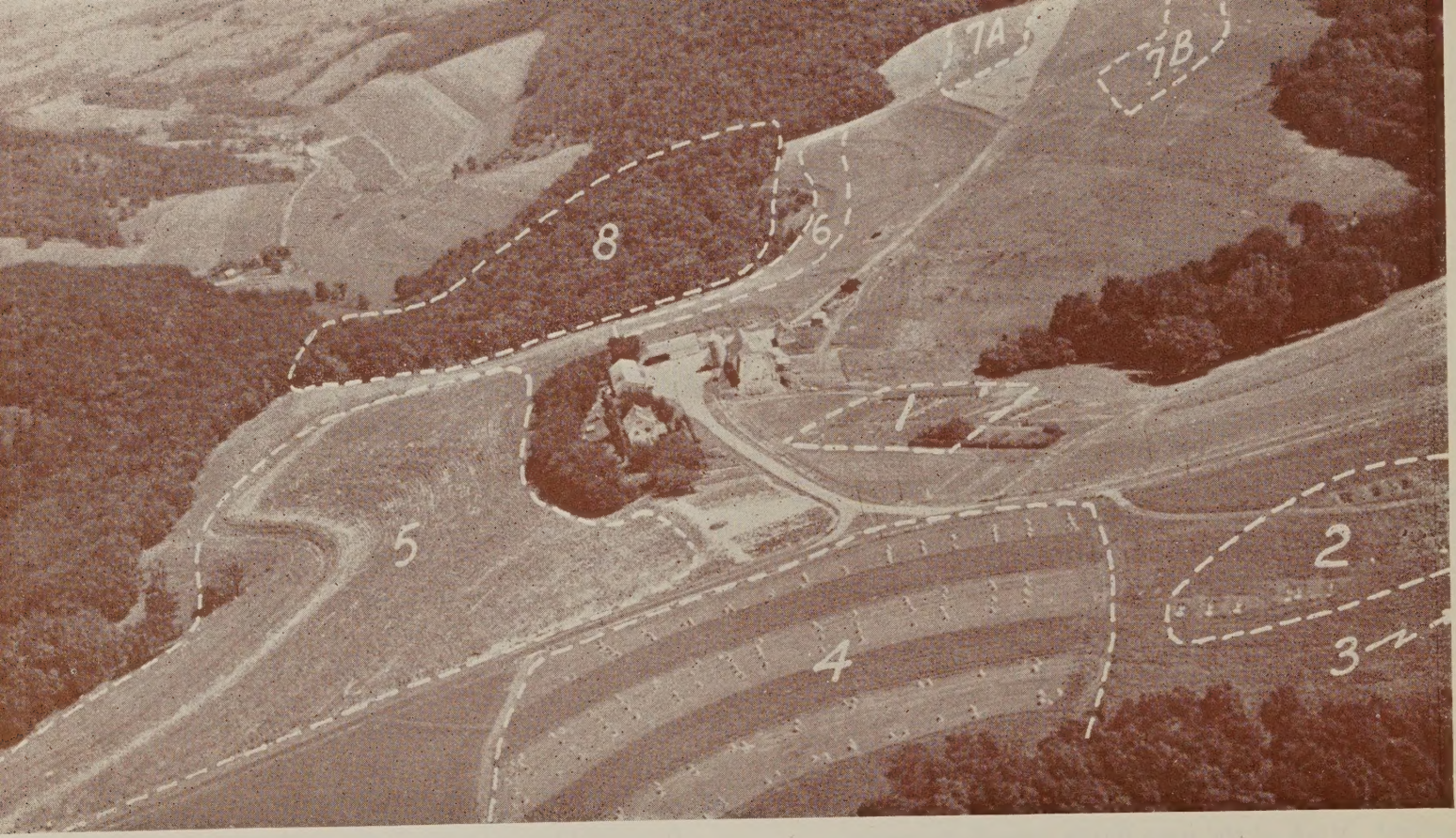
To bring back the producing power of this land was the first problem. Erosion cannot be controlled on unproductive cultivated land.

Terraces and strip cropping were used to hold the soil so that runoff and erosion would be reduced. Then lime and fertilizer were added in order to grow alfalfa. The growing of alfalfa allowed us to have rotations including three and four years of hay. When the hay was plowed under for corn a considerable amount of the top growth was returned to the soil so that slowly we have increased the organic matter and producing capacity of our farm.

The pastures were renovated and some of the steepest crop land was seeded down to legume and grasses for pasture. The timberland was protected from grazing and fire.

Putting each acre to its best use meant we could increase the number of cows on the Station without buying more feed. The number of milking cows has been doubled although the crop and pasture acreage has remained the same. In fact, the productive acreage has been lowered because some of the land between the plots is not harvested. The purchased feed bill for the livestock has been reduced to one-third. This is the result of a better land use program which improves the land as we wisely use the soil resources.

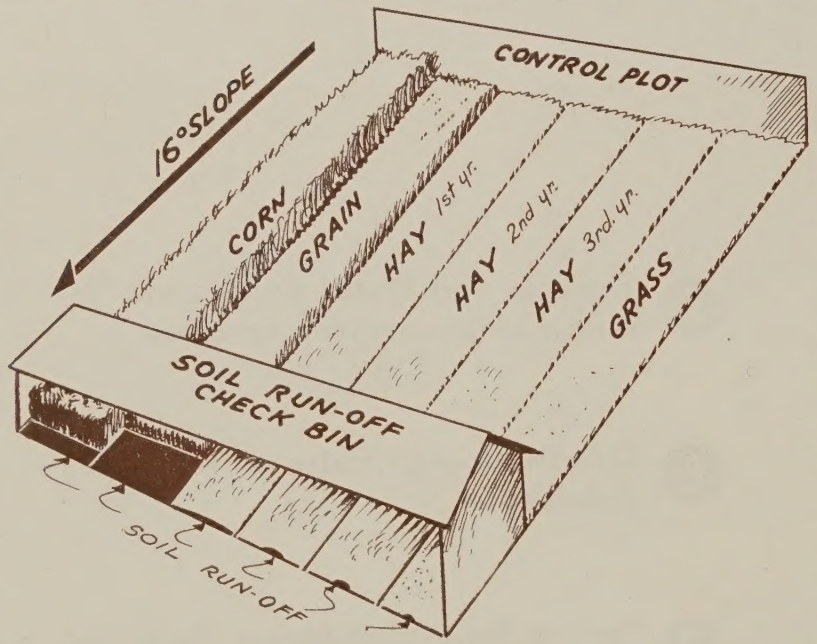
In order that you may see the work on each of these land use areas, the tour will consist of eight stops. At each, important ideas in conservation have been put into practice.



These are the areas you will visit on your tour.
See small guide maps on following pages for suggested route.

STOPS on Your Tour

1. Soil and Water Losses Vary with the Crops Grown.
2. The Steeper the Slope the Greater the Loss.
3. Organic Matter is Essential for Good Crops and Erosion Control.
4. Strip Cropping Reduces Soil Losses.
5. Terraces and Water Outlets are Essential to Conservation Farming.
6. Grassland Agriculture for Steep Cropland.
7. Pasture Renovation Makes Worn-Out Pastures Highly Productive.
8. Protected Woodlands (1) Stop Runoff and (2) Become an Important Crop.



THE CROPS under measurement are corn, grain, hay, and bluegrass. The greatest soil loss during the past 11 years was from grain following corn. The losses from corn fields following hay were greater than from grain fields following corn only during one year. Bluegrass lost the least soil of all.

The soil and water running off these small, 16% slope plots have been measured for each rain and thaw since 1932. Each year we have from 15 to 20 periods when some soil and water are lost. On the average, however, only four rains a year cause 95% of the soil loss and 84% of the water runoff. To control erosion, it is necessary to use conservation measures that will hold soil and water effectively during these few intense storms.

All of the soil that was washed from the plots during 1932 to 1938 is stored in bins. Look at the amount of soil in the bins and on the plots above the building. The difference in depth of soil in the plots is due to soil which has washed into the bins.

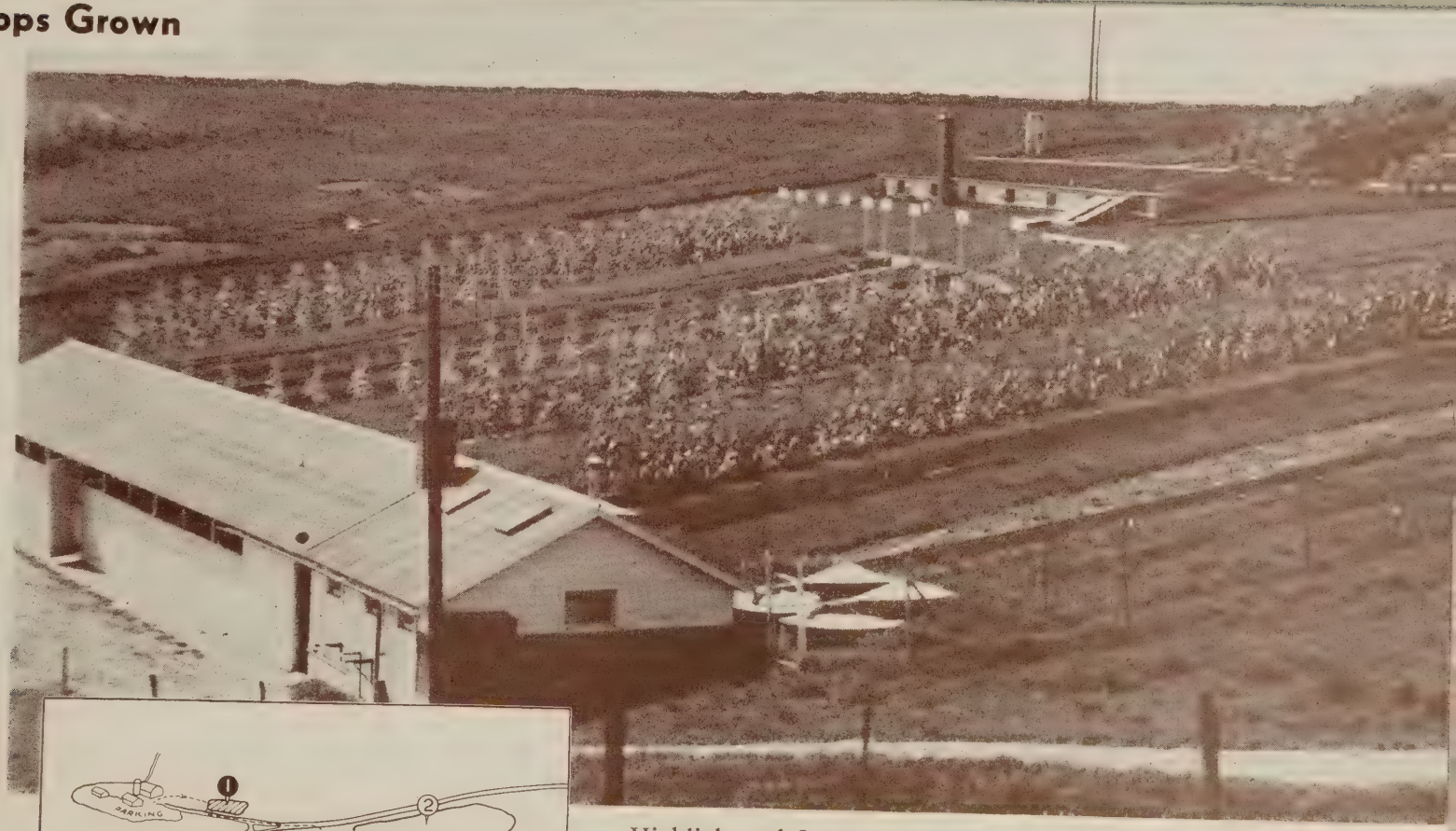
The soil in the bins contains about 2 times as much organic matter and 5 times as much phosphorus and potassium as the original soil on the plots.

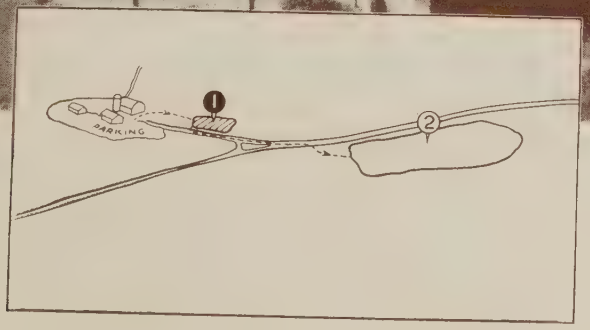
By 1939 some plots had only 3 inches of surface soil. Others had 6 inches. All were placed under uniform treatment. We used a 5-year rotation of corn, grain, and three years of hay. A heavy application of phosphorus and potassium fertilizer was used on the grain.

The loss of soil and water from the plots with the 3 inches of topsoil has been much higher than from the plots with the 6 inches of topsoil. The water and productive soil which have been lost are needed for better crop yields.

The plots with the **6 inches** of surface soil produced **4 bushels more corn** and **28 bushels more oats** than the plots with only 3 inches of surface soil.

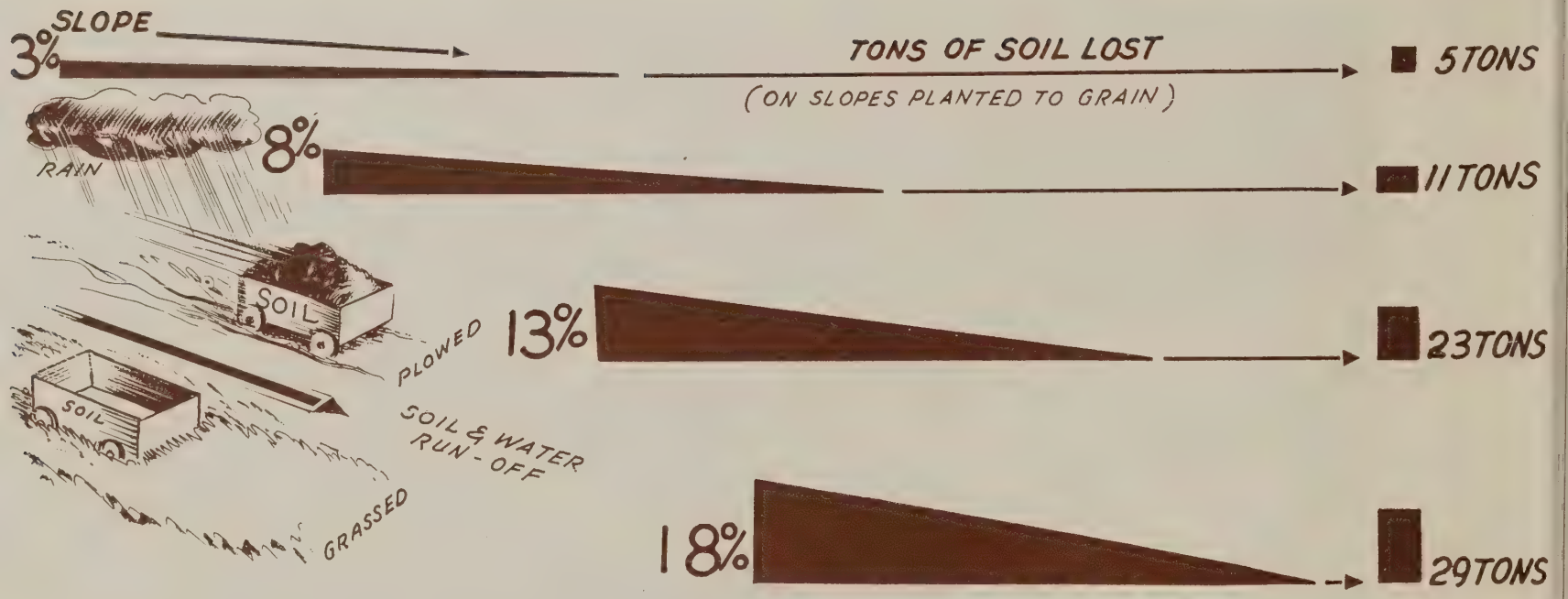
Can you afford to lose crop yields by erosion? Few of us can.





Highlights of Stop 1— *Control Plots*

Erosion reduces crop yield
Reclaiming soil is very expensive
Dense vegetation controls runoff and erosion
Rotations with several years of hay help control soil and water losses



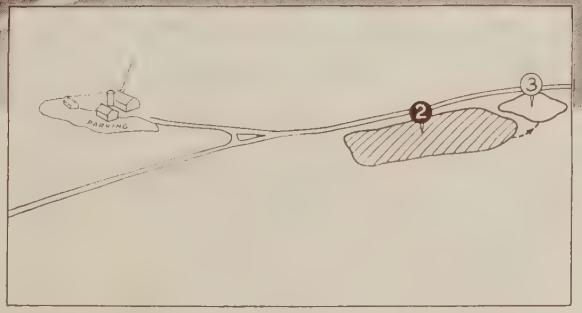
EROSION may be severe even on the gentle slopes. The plots pictured are on a 3% slope. They lost more than 5 tons per acre even though the slope is only 72 feet long.

Soil losses are much greater on steep slopes. Water runs off a steep incline much faster than from gentle slopes and carries off much more soil.

Records from a 6-year study show that with a 3% slope 5.1 tons of soil were lost from the grain field. With an 8% slope, 11 tons; with a 13% slope 23 tons; and with an 18% slope 29 tons were lost.

What percent of slope do you have on the fields of your farm? Slopes of more than 15% should not be planted to cultivated crops. If you want to check the slopes of your fields, your Soil Conservation District will be glad to help you.

Greater the Loss

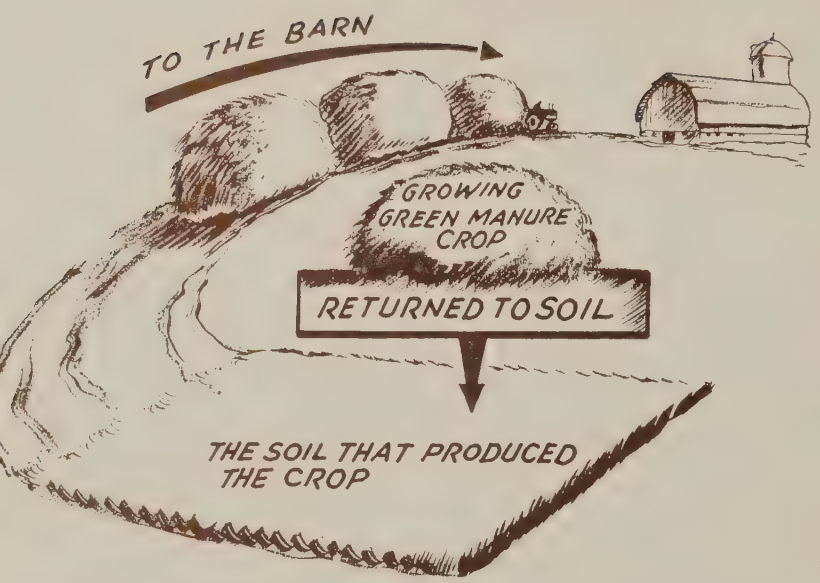


A 3% slope measured for soil and water losses

Highlights of Stop 2—

High soil losses may occur on gentle slopes
Highest losses occur on steep land
Land steeper than 15% should never be in a row crop

Stop 3: Organic Matter is Essential



WHETHER you are farming level or sloping land, organic matter is essential for good crops and erosion control. It adds fertility and helps to hold moisture. Organic matter acts as a sponge to soak up rainfall and reduce water run-off.

When plants and roots of plants decay and get mixed into the land, they become organic matter in the soil. Barnyard manure and plowed-under crops or crop waste are good sources of organic matter. Increase this valuable part of the soil by growing more grass.

Sloping land should be in legume-grass at least half of the time. One acre of good, healthy alfalfa during a growing season will take about $15 worth of nitrogen from the air and build it into the protein of the plant.

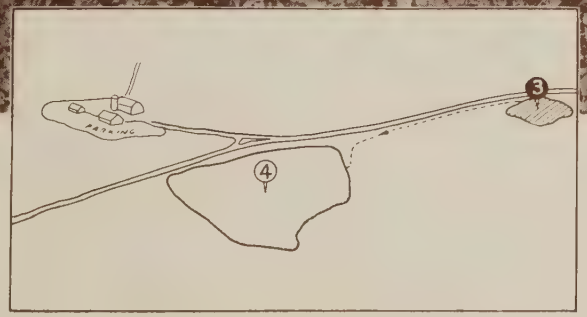
When plowing hay land for corn, plow under as much aftergrowth as possible. It adds nitrogen and organic matter to the soil. Plowing under the second crop of alfalfa reduced soil losses by 13 tons per acre and runoff by 0.6 inch. Grazing before plowing means that less aftergrowth is plowed under. This robs the soil of needed organic matter.

No farmer can afford to waste barnyard manure. At the Station, 8 tons of barnyard manure per acre increased corn yields 12 bushels per acre. Soil losses were reduced 12 tons per acre and water run-off 0.6 inch. A little barnyard manure goes a long way.

On grain, 3 tons per acre reduced soil loss from 3.2 to 1.9 tons per acre and water run-off from 2.3 to 1.7 inches. Using 3 to 5 tons of barnyard manure as a light top dressing on grain after seeding has been completed has given good results at the Station.

Caution: Be careful to apply manure on the contour so that the spreader wheel tracks will not increase erosion.

How about the organic matter in the soil on your farm? Are you making the best use of barnyard manure? Do you need to plow under some alfalfa brome to take the place of lost organic matter?



Highlights of Stop 3—

Hay has been made. Growth shown is returned to the soil

Organic matter acts like a sponge
Barnyard and green manure return fertility to the soil
Return a part of the crop growth to the soil
Don't waste a load of barnyard manure

ALTERNATING strips of grass with grain or other crops helps to reduce soil and water losses.

This watershed has 6 contour strips 45 feet wide on a 17% slope. It is planted to a rotation of corn, grain and four years of hay. The soil lost since 1939 averaged 3 tons per acre a year. Losses were highest when grain or corn was on the bottom strip. In most cases, a system of grassland agriculture without row crops should be followed on slopes steeper than 15%. The yield of corn has averaged 5 bushels per acre more than on land that was not strip cropped or terraced. The 12 year average yields are corn 64 bushels, oats 71 bushels, and alfalfa brome hay 2.9 tons per acre.

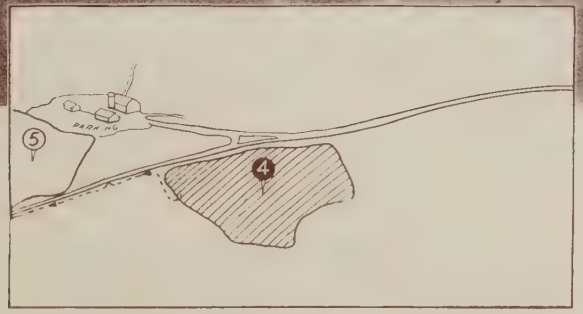
Another strip cropping study is located near Coon Valley. The land slope is 11% and the rotation is corn, grain, and 2 years of hay. The strip cropped plots lost only 46% as much soil as contour plots in the same rotation. The 10-year average soil loss from the contour strip cropped plots was 2.2 tons per acre. The wider the strip of grain, the higher the soil loss. The 75 foot width strips lost 20% and the 100-foot strips 27% more soil than the 50-foot width of strip.

Strip cropping is a good conservation practice on slopes that are not too long. Strip cropping **does not reduce length of slope.** The slope of the hillside, including the pasture land above, should not be over 250 feet in length, if strip cropping is to control erosion.

The right way of strip cropping—**going around the hills**—keeps all crops on the level. We call this contour strip cropping. If your strips are not on the level you are not practicing contour strip cropping.

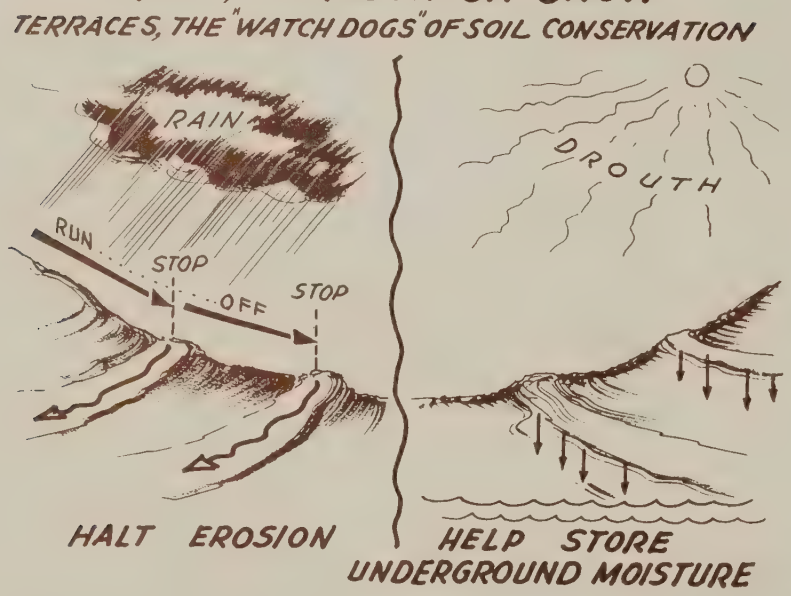
The use of the two-way plow helps strip cropping control erosion. Turn all soil one way—up hill. The dead furrow will then be left at the bottom of the strip.

Strip cropping is not difficult or expensive to put to work saving your soil.



Highlights of Stop 4— *Strip cropped watershed*

Contour strip cropping will reduce soil losses one half
Success in strip cropping depends largely on having a good dense hay crop
Contour strip cropping increases crop yields
Field must be divided by terraces if up and down length is greater than 300 feet



TERRACES are troughs across a field. They lead the run-off, emptying it into a well built waterway. Diversions are large terraces built for a special purpose.

Our records show that one cannot afford to take the chance of having an entire field in corn or grain even though the crops are planted on the contour and a long rotation is used unless terraces are a part of the control system.

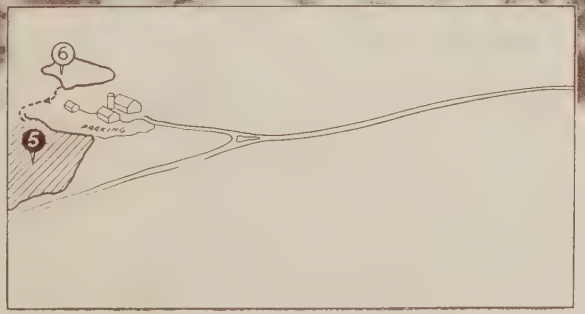
We have found that terraces are the best way to control erosion and water run-off on cultivated land. They are the only known method of reducing the length of slope. Corn yields at the Station are highest on terraced land. The yield of corn exceeded unterraced land by 4 bushels per acre.

Our field terraces are designed to carry the peak load of run-off expected. They vary in size depending upon the spacing and have a grade of 3 to 6 inches per 100 feet toward the outlet. Terraces must be laid out accurately by a technician with a surveying level and be designed for the run-off and erosion hazards of the field.

Terraces give these advantages: (1) low soil losses, (2) 7% higher crop yields, (3) entire fields can be in one crop in any one year, and (4) we can use one year less hay in the rotation than in strip cropping. These terraces have been maintained by using the two-way plow. The dead furrow is left in the channel and the back furrow on the ridge once in each rotation. If properly maintained, terraces are always ready for the hard rain and protect your soil the year around.

Diversion terraces are bigger than field terraces. They must have more capacity and a steeper channel grade. The terrace plus 20 feet above it must be kept in hay. Diversion terraces can be renovated to re-establish legume grass mixtures. Diversion terraces are waterways on the contour. They control gullies and reduce the need for waterways in the field.

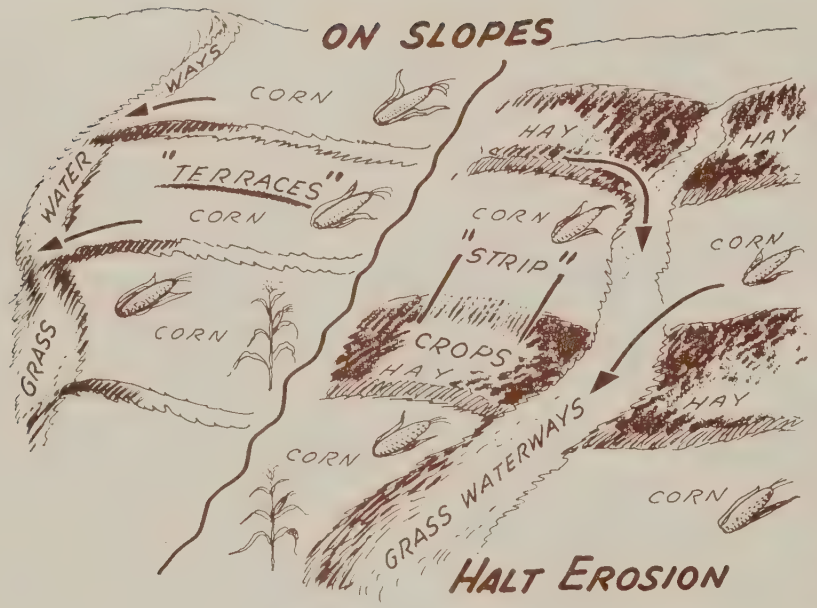
Do any long slopes on your fields need terraces?



Highlights of Stop 5—

Terraces:
- Reduce length of slope
- Reduce number of waterways
- Increase crop yields by 10%
- Give year around soil protection

Terraces ready for runoff



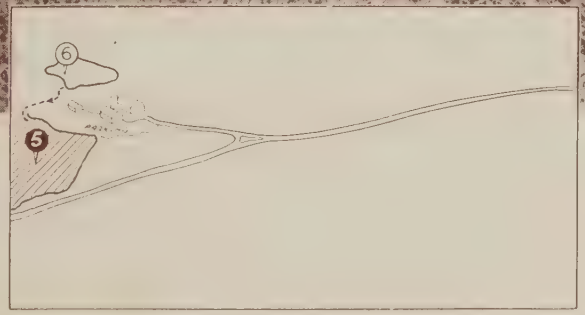
Outlets and Waterways

Terraces bring together in one channel the run-off water from an entire field. We need to provide a safe outlet to carry the water from the terraces down the slope. Outlets must be finished with a good sod or other protective covering before any terraces are started.

The most practical outlet empties onto a ridge in a good pasture. If this is impossible, a grass outlet can be constructed on good soil when the slope is less than 30%. This can be done by digging a channel into which water can flow. Build the outlet so it can be crossed easily with machinery. If the outlet is to be used right away, it should be sodded. If the outlet can be prepared a year before the terraces are built, it can be seeded to a suitable grass mixture and the grass on the waterway can get a good growth before it is used to carry water. There will be less rodent trouble if the grass is mowed or pastured to a 3 or 4-inch height.

When the soil is poor or the slope is steeper than 30%, a specially built surfaced channel is needed. Tar rock, sheet metal and wooden flume outlets have been under study since 1935. Each has given excellent service and needed little care. The tar rock outlet was the cheapest to build—much like building black-top roads. Properly located and maintained, outlets and waterways will prevent costly gully control.

Is there a place for some well-planned outlets or waterways on your farm? Do you have any small gullies starting? A small gully is easily stopped. An early start may save a lot of expense.



More Highlights of Stop 5— *Grass waterways runoff.*

Bluegrass sod is best outlet on good soils with slopes of less than 30%
Tar rock, sheet metal, or wooden flume outlet under other conditions
A good outlet is required whenever runoff concentrates on a slope

IN THIS EXPERIMENT, we are lengthening our rotation by keeping our land in grass more of the time. We are using a rotation of corn, grain, and four years of hay in comparison with grain and five years of hay. Some of the land is plowed and some of the seedbeds are prepared with a large field cultivator. This experiment has not been underway long enough to draw any definite conclusions.

However, corn on plowed hay land lost 19 tons of soil per acre in 1950, grain following corn lost 63 tons per acre. Grain planted on hay land which had not been plowed but had seedbed prepared with a large field cultivator lost only 3 tons per acre. These plots are located on a 20% slope.

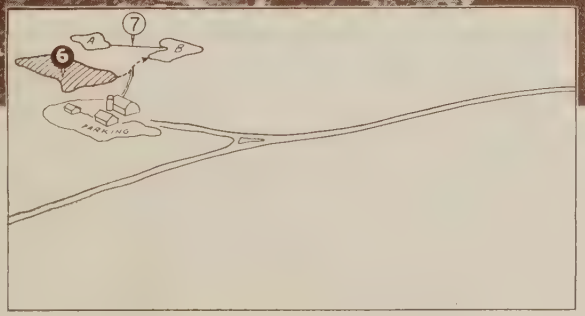
The method of seedbed preparation and the losses in the seeding year also influence the losses in the first year of hay. First year hay in the rotation of corn, grain, and four years of hay lost 3.5 tons of soil per acre as compared with first year hay in the rotation of grain and five years of hay which lost only 0.02 ton per acre.

Wisconsin is in an ideal climate to expand its grassland farming and livestock industry. These two enterprises go together. While keeping land in grass helps to save the soil, the growing of good legumes also helps to cut the feed bill. It is the cheapest way to provide the dairy cow with low cost protein feeds. The wise dairyman feeds his cow a balanced ration. The wise farmer will also feed his crops a balanced ration by adding needed plant foods to the soil. He will then protect these plant foods and the soil from erosion.

Do you have steep land that erodes severely when planted to corn? Use a cornless rotation on steep crop land.

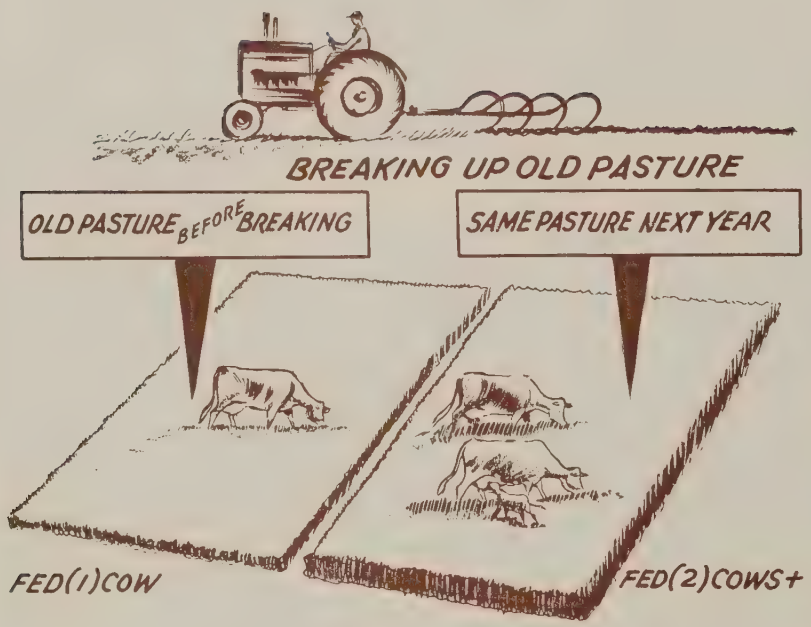
How about your winter feed bill? Is it protein concentrates you need? A good legume roughage, hay or grass silage, will help you reduce that cost.

teep Cropland



Highlights of Stop 6— *Cattle on alfalfa-brome*

Slopes in excess of 15% should be in rotation without row crop
Good stands of hay are obtained in cornless rotations
On land that washes easily do not plow



PASTURES can be made much more productive by a liming, fertilizing, and reseeding program. On sloping land this needs to be done carefully to control loss of soil.

To give pastures a chance to "pay their way", we must give them as much attention as other cropland. It takes 2½ acres of good bluegrass pasture to provide feed for one cow for the pasture season. An acre of good alfalfa brome pasture will take care of 1.3 cows.

We kill the bluegrass with a good field cultivator, leaving the grass roots and stubbles on the surface. We lost only 0.03 ton of soil when we used the field cultivator and 4 tons per acre when we plowed. We produced 3.1 tons of dry forage on a pasture renovated with a field cultivator as compared with 2.8 tons per acre when the plow was used.

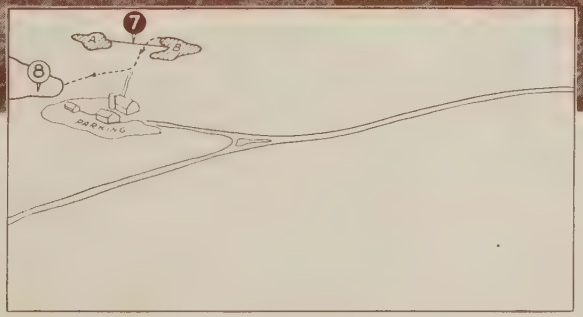
We begin tillage with a good field cultivator in August when it is dry and hot. We set the teeth to cut only two inches deep. We work the land a second time after the loosened vegetation and soil have dried out. The following spring we work the land once to prepare a rough seedbed.

The second step is providing a fertile soil. A soil test will show the fertilizer and lime needs of the land. We apply 500 pounds per acre of 0-20-20 fertilizer at seeding time. Grain is seeded at one-half bushel, alfalfa 8 pounds, and brome 6 pounds per acre.

The third step is good management after seeding. If the grain is pastured, turn in enough cattle to graze off the area in a couple of days. If the growth of legumes is very good, the area may be grazed lightly after October 15 of the seeding year. Overgrazing of the established alfalfa brome pasture, we have found, reduces the yield and stand of legumes, and also increases run-off. Our dry forage yield was 3 tons per acre where grazed to about 4 inches and 2.6 tons where grazed to 2 inches.

Give legumes a chance and they give cows a chance.

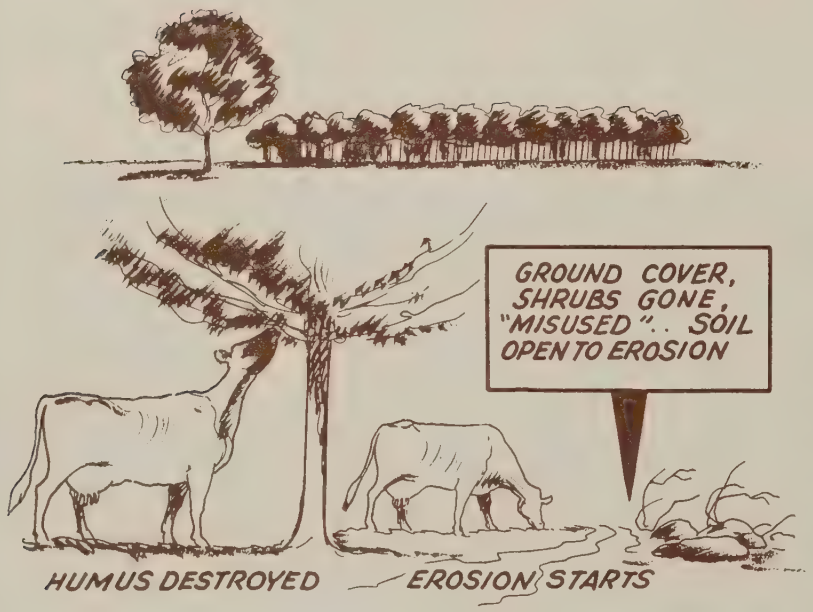
on-Out Pastures Highly Productive



Highlights of Stop 7—

Make one acre do the work of two
The cheapest milk is produced on pasture
Don't let your cows search for feed
Renovate with a field cultivator

Bluegrass killed with a field cultivator leaving a desirable rough surface



OUR WOODLANDS can be a source of dependable income when properly managed. They also help to prevent soil and water losses.

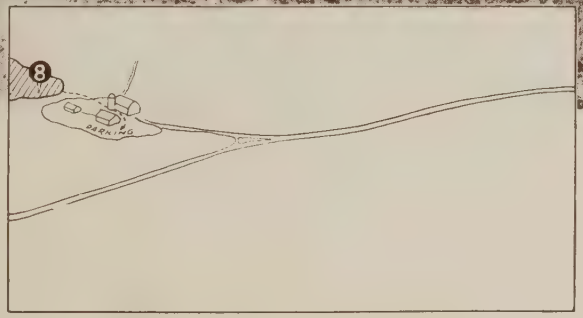
At the Station an 11-acre timber watershed has been protected from fire and grazing since 1932 when it was established by the U. S. Forest Service. There has been no run-off (water loss) from the area since 1936. This is due to the now very loose and open condition of the soil to a depth of about 6 to 8 inches which makes it capable of drinking up even the most intense rain and holding most of the water for the timber crop. The annual crop of leaves falling on the surface has been allowed to remain where it fell, and in time it has improved this soil so that it can absorb even the hardest rain without water run-off.

When woodland is protected from fire and grazing and is properly managed, it will provide a good crop of timber. Most farmers depend upon home grown wood for fuel. Properly managed timber produces an annual harvest as a source of lumber and income. Even birch, popple, and other trees of low market value can be used for fence posts if properly treated with zinc chloride or other preservatives. Birch posts treated with zinc chloride in 1939 and set in a fence are still good—12 years later.

Pastured woods yield very little pasture and only a small crop of timber products. Livestock destroys the small seedlings and trample the ground so hard that there is not much chance for new trees to start.

Farm woodlands are the nation's largest suppliers of wood products. Is your woodland being given a chance to add to your farm income and the nation's needs? Is it being managed in such a manner that it can soak up even the most intense rain and thereby help to reduce floods?

nd (2) Become an Important Crop



Highlights of Stop 8— *Woodland—good management—poor management*

Properly managed woodlands become a valuable farm crop
Pasturing produces neither feed nor forest but lots of run-off
Cows and timber do not mix
Cows are poor foresters

Put Your Acres to Their Best Use

The first step is to check your farm carefully for signs of erosion. Even small washes indicate high soil losses. Note how many gullies and small ditches you may find in corn and grain not planted in contour strips or terraces on sloping land. Then decide what conservation practices you will need to use to check erosion on every acre.

Talk over your problems with your County Agent. If your county is organized into a Soil Conservation District, see the farm planner of the Soil Conservation Service.

We cordially invite you to visit other soil management research fields at Marshfield, Owen, Madison, Spooner, Hancock, Ashland, and Sturgeon Bay. At each Experiment Station, studies are being made to help farmers in these areas put their acres to best use.

The picture of the Station on the opposite page shows how a conservation farm plan fits the land. In this strip cropping system, long winding rows on the contour cling to curves on the slopes. Bands of close-growing grasses between the corn and grain crops slow the water run-off and hold the soil. The longer slopes in the foreground to the left are terraced to break the slope into a series of short watersheds. Water runoff is slowed to a walk by the terraces and loses its destructive force. Note the contour fence below the corn strip.

Pasture and woodland occupy land that is too steep or otherwise undesirable for cultivation. Run-down pastures have been restored to high productivity by seeding legumes with grasses and fertilizing—without plowing. The trees around the buildings serve as a windbreak.

Every acre thus is put to its most efficient use—without waste—the goal of every good conservation farm plan.

The conservation farm plan used at the La Crosse Experiment Station fits the land like a tailor-made suit of clothes.

Farmers and Agricultural Research go Forward Together

● Much of northwest Wisconsin was settled by people who came to this state from central and northern Europe. They loved the hills and the valleys; they were so much like the land from which they came. The rainfall, however, was quite different. They were not accustomed to the heavy cloud bursts of rain that is so much a part of the rainfall of Wisconsin. The rains back home were slow and drizzly. As settlers opened the land on their farms to plant and grow crops, the soil was exposed, as far as they were concerned, to a new kind of problem because of this rolling topography and the heavy rains.

The early settlers of this area sensed the problem early. They became aware of serious soil losses before the century had passed. The loss of topsoil meant the loss of the productivity of the land. Erosion is selective. It carries away the best of the fertile topsoil. It reduces yields.

To meet this problem they planted certain crops in strips across the hillsides as early as 1845. The strip cropping in Mormon Coulee is an example of this foresight. It was started over 50 years ago.

In order to assist farmers in meeting the problems involved in putting each acre to its best use, careful testing and improvement of methods and practices to be followed was necessary. You have seen some results of these studies in your tour today.

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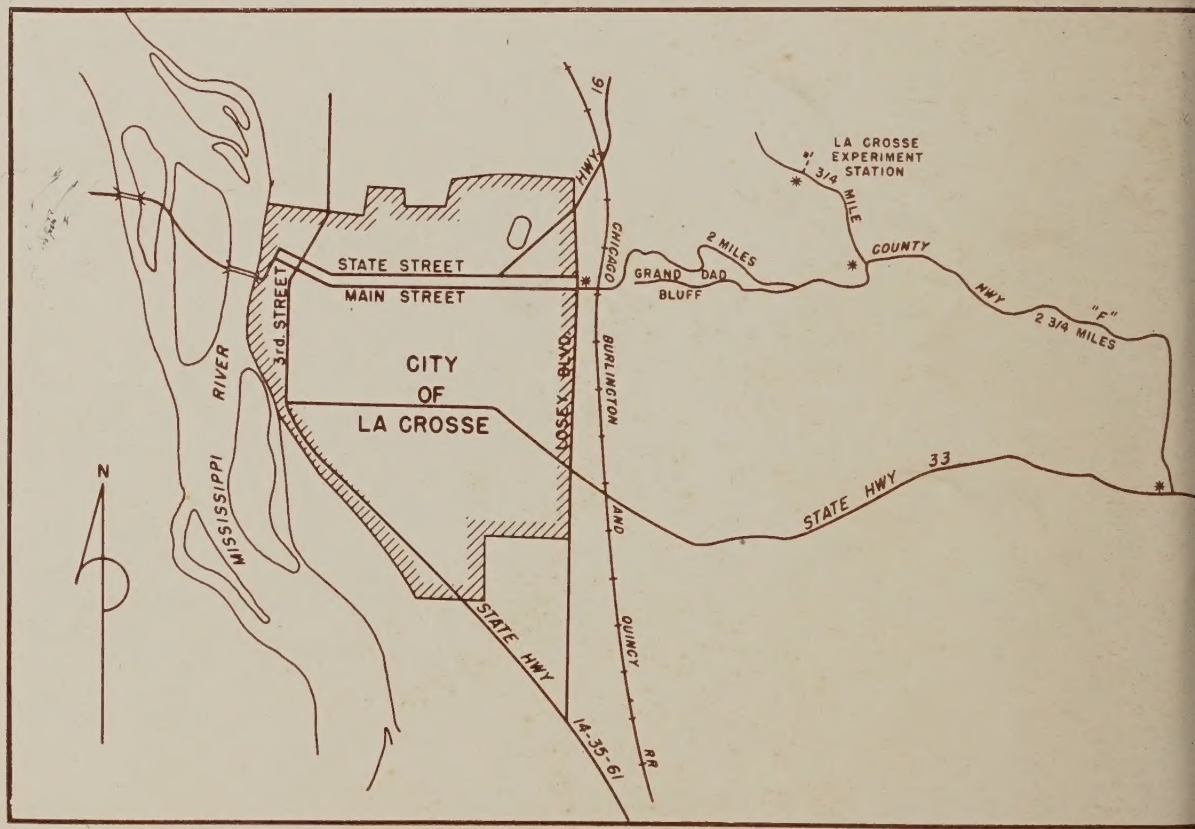
Finding your way to the Soil Conservation Experiment Station
at La Crosse, Wisconsin



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